FIG.1

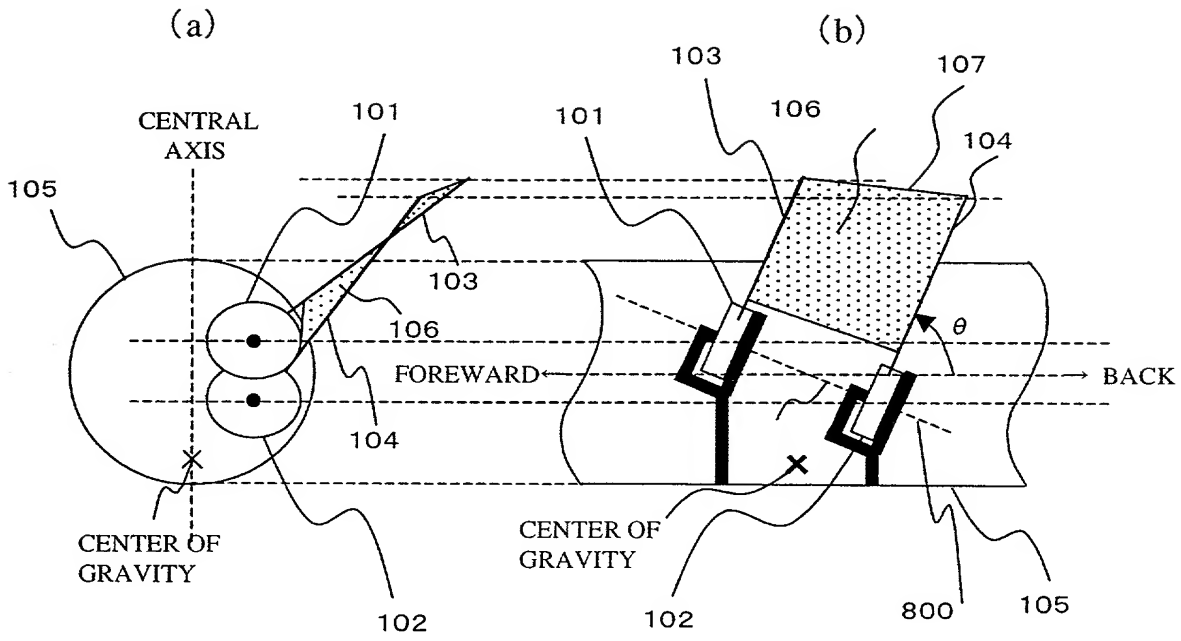

(a)
(b)
CENTRAL AXIS
101
101
103
106
107
104
105
103
106
θ
FOREWARD
BACK
104
CENTER OF GRAVITY
CENTER OF GRAVITY
102
102
800
105

FIG.2

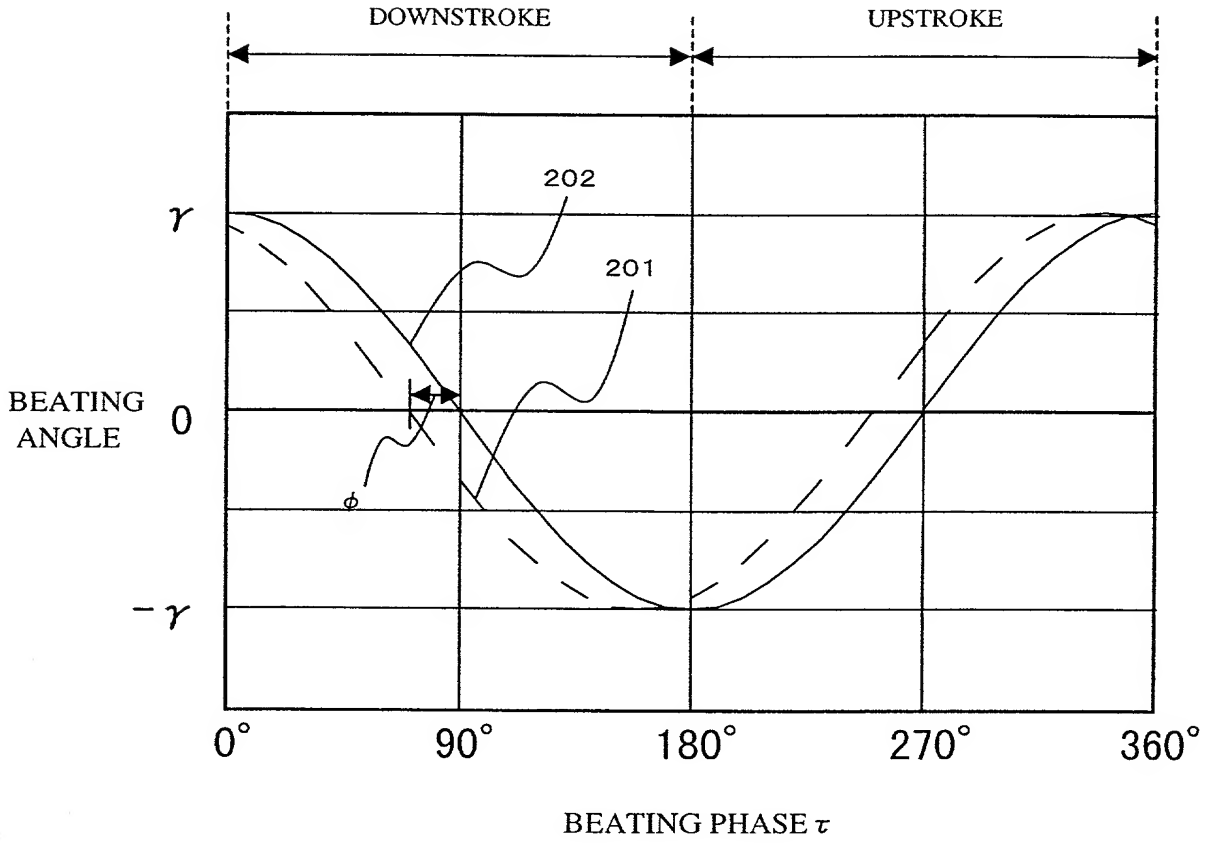

DOWNSTROKE
UPSTROKE
202
201
γ
BEATING ANGLE
0
$-\gamma$
ϕ
0°
90°
180°
270°
360°
BEATING PHASE τ

FIG.3

$\tau = 0°$

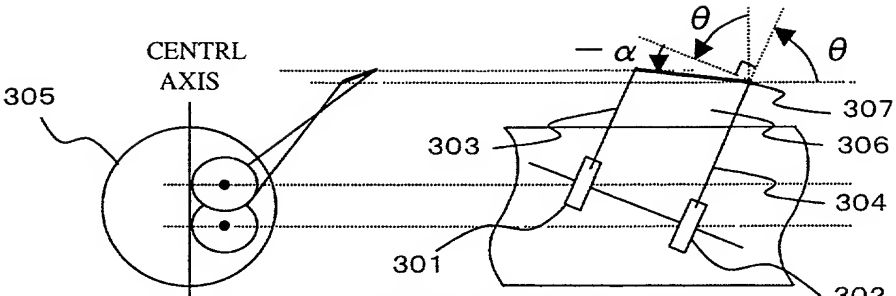


FIG.4

$\tau = 45°$

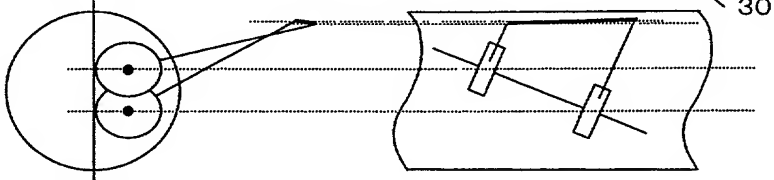


FIG.5

$\tau = 90°$

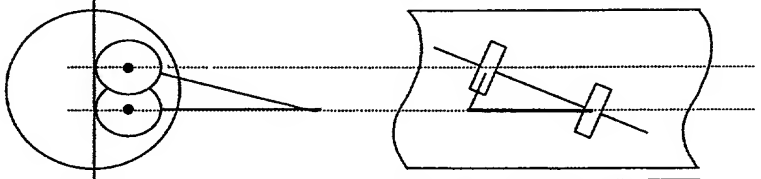


FIG.6

$\tau = 135°$

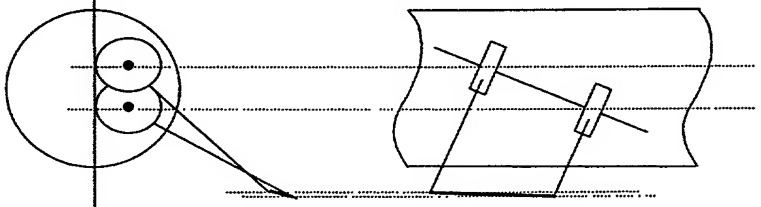


FIG.7

$\tau = 180°$

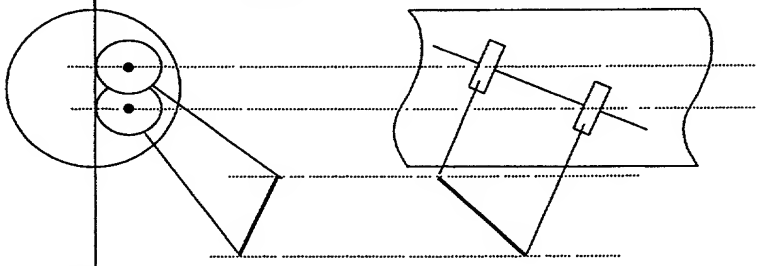


FIG.8

$\tau = 225°$

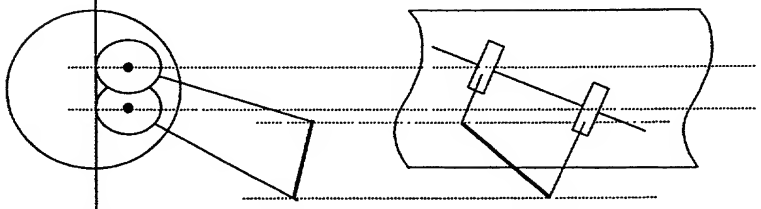


FIG.9

$\tau = 270°$

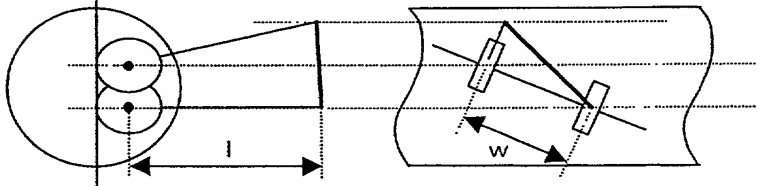


FIG.10

$\tau = 315°$

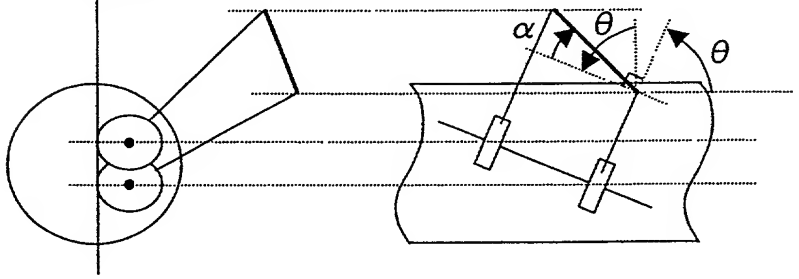


FIG.11

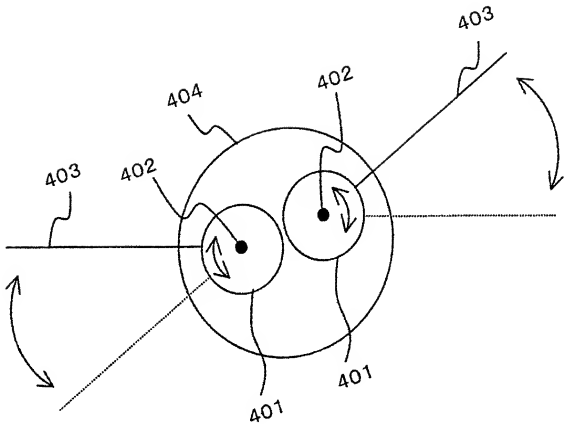


FIG.12

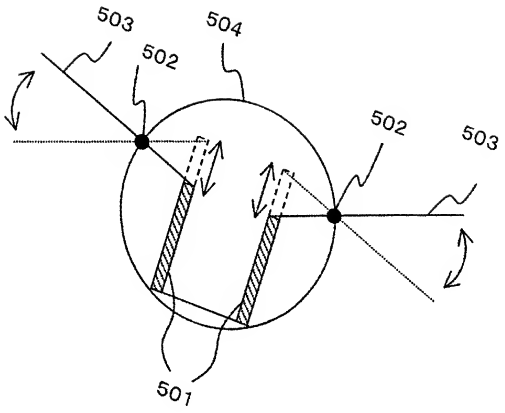


FIG.13

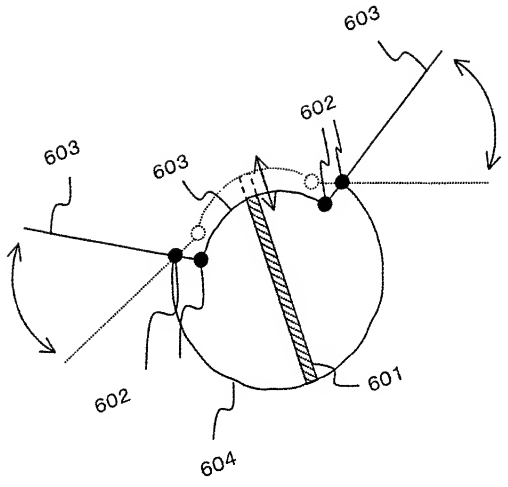


FIG.14

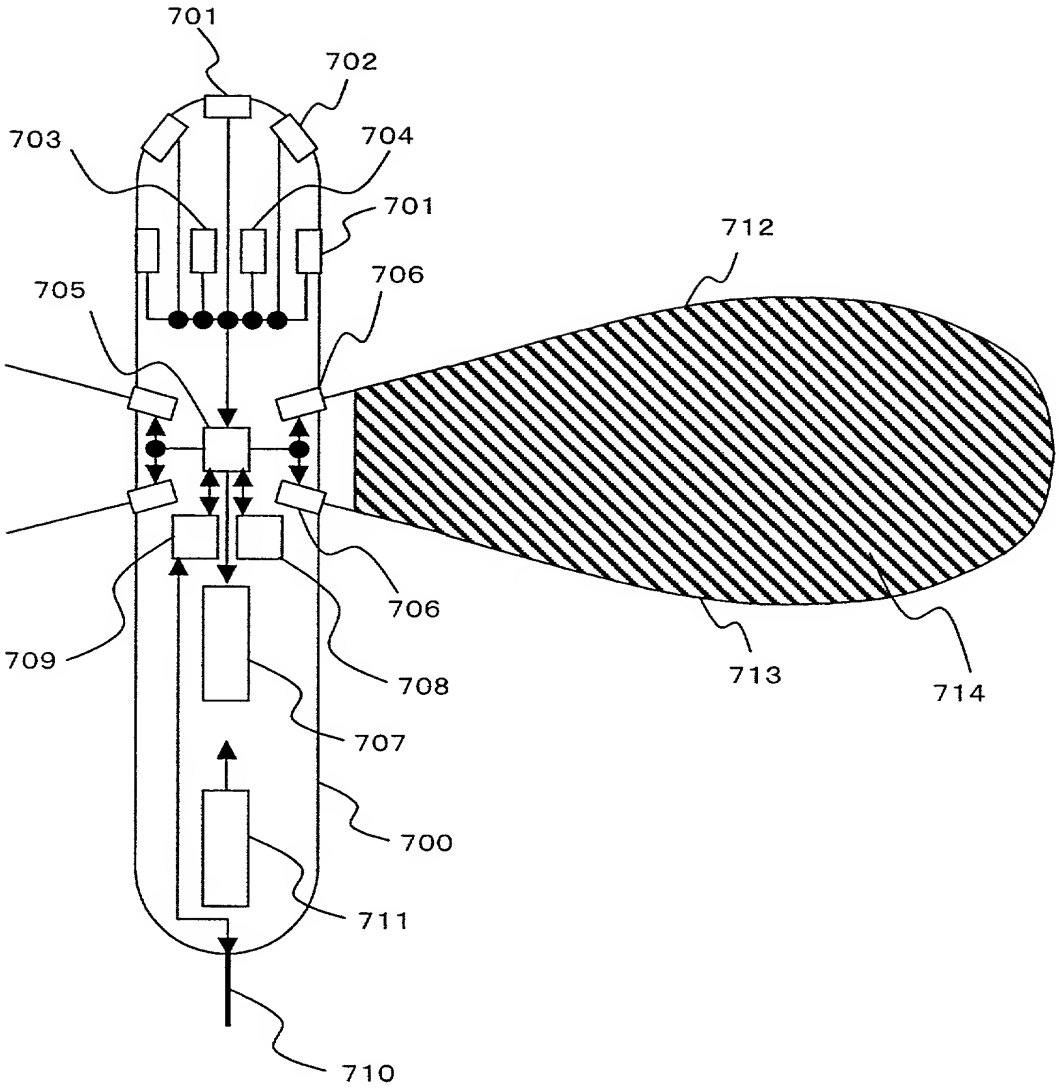

701
702
703
704
701
712
705
706
706
709
708
713
714
707
700
711
710

FIG.15

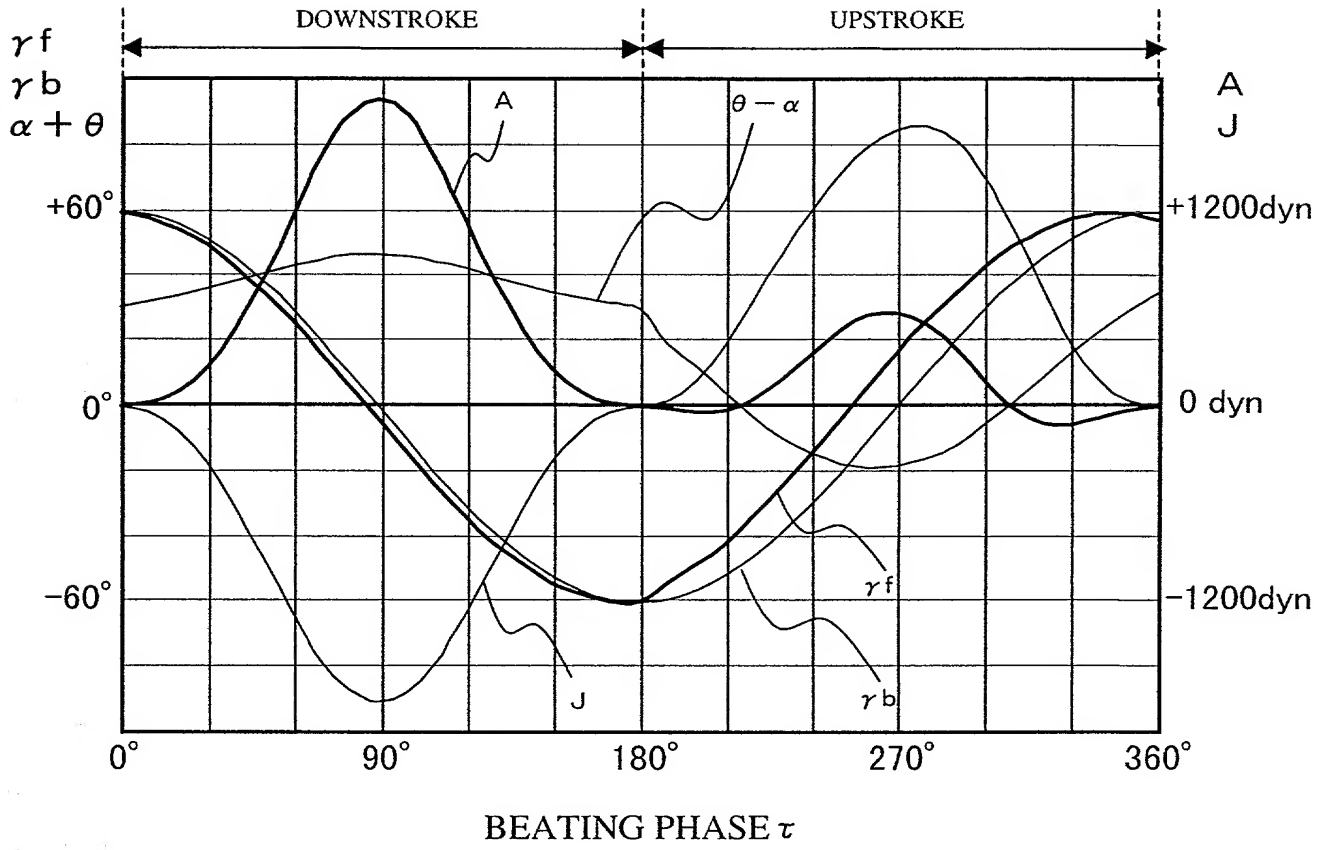
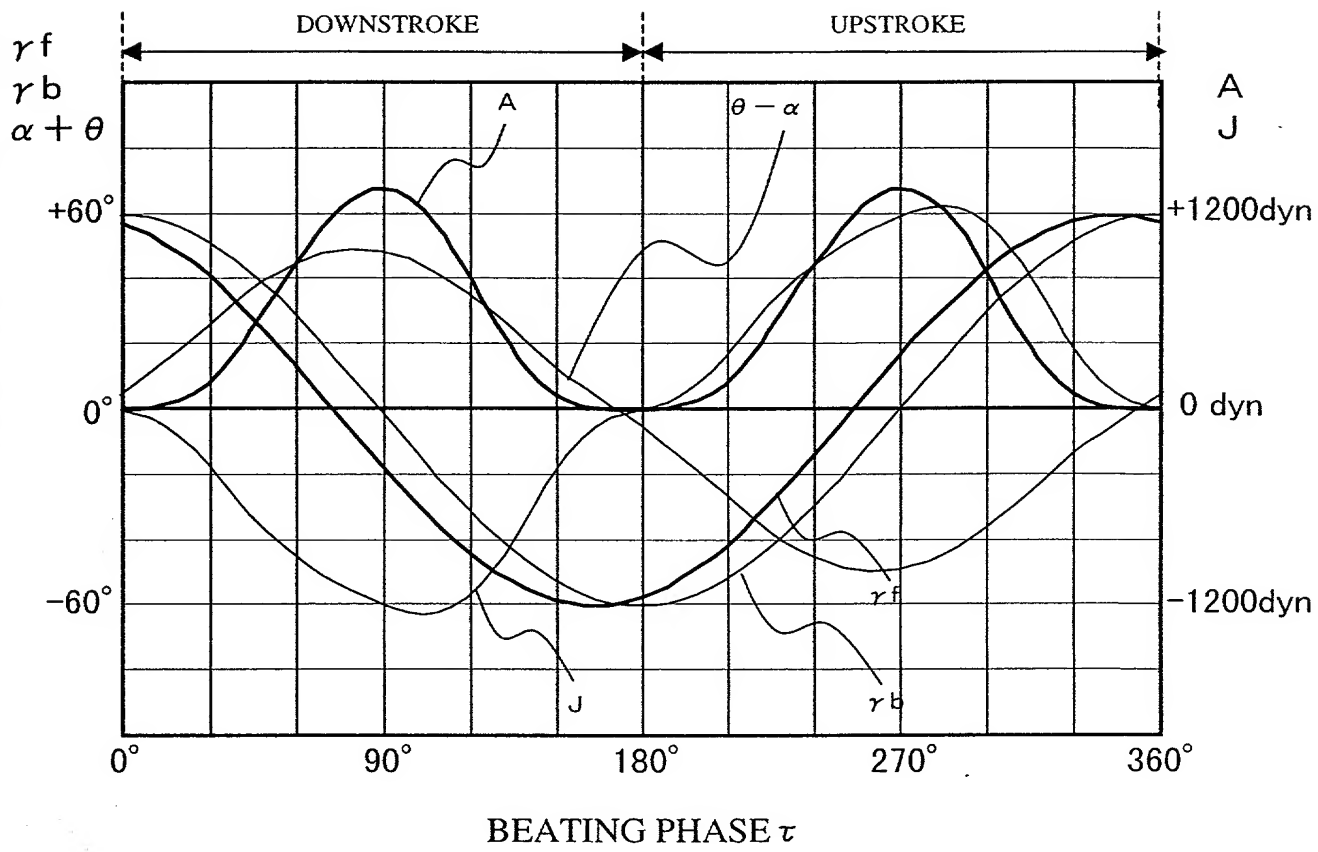

DOWNSTROKE
UPSTROKE
γf
γb
α + θ
A
J
θ − α
+60°
0°
−60°
+1200dyn
0 dyn
−1200dyn
0°
90°
180°
270°
360°
BEATING PHASE τ

FIG.16


DOWNSTROKE
UPSTROKE
γf
γb
α + θ
A
J
θ − α
+60°
0°
−60°
+1200dyn
0 dyn
−1200dyn
0°
90°
180°
270°
360°
BEATING PHASE τ

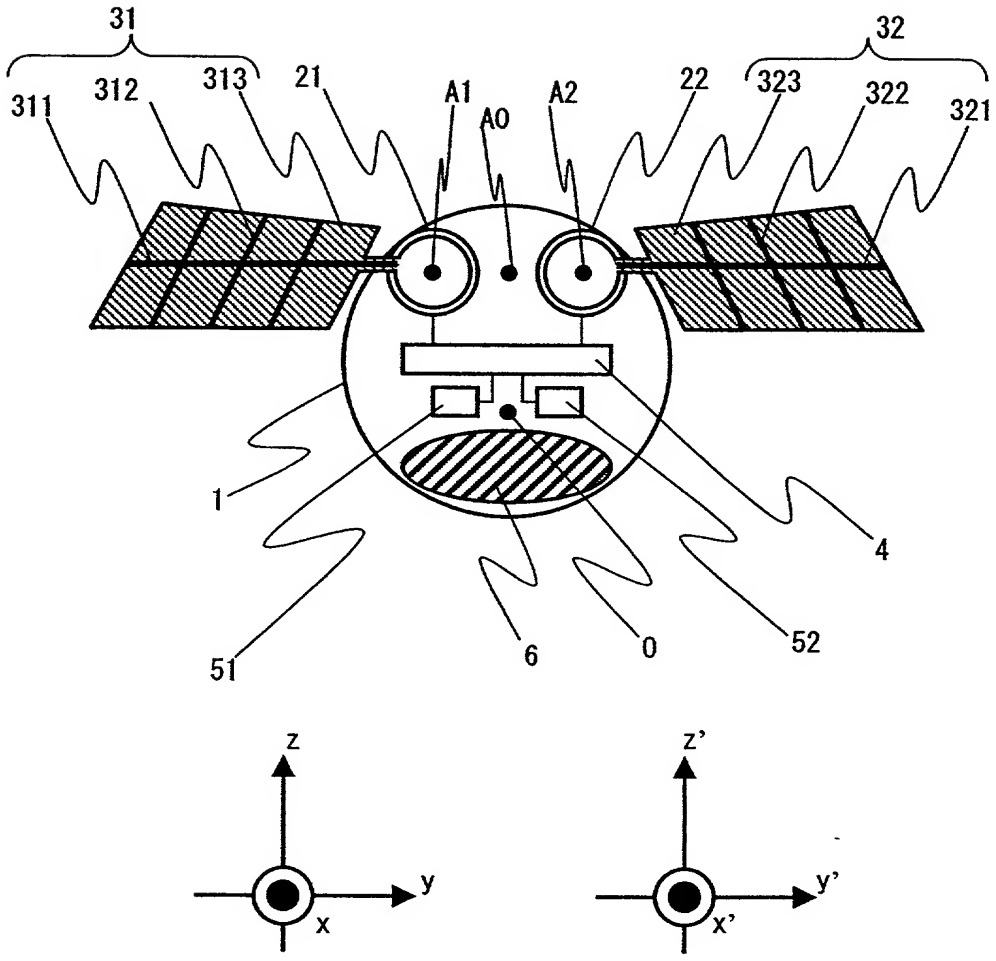


FIG. 17

Document: US 2022/0254702 A1

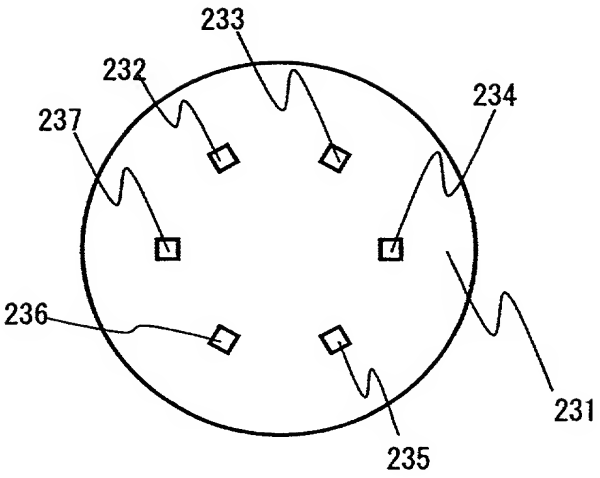


FIG. 18

20220404

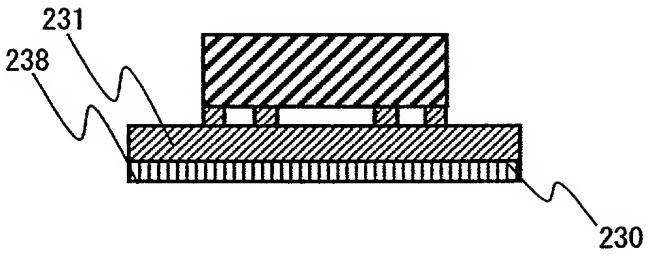


FIG. 19

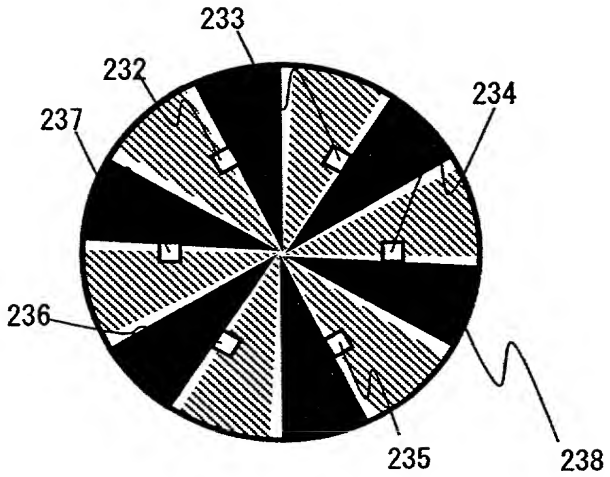


FIG. 20

Application Publication

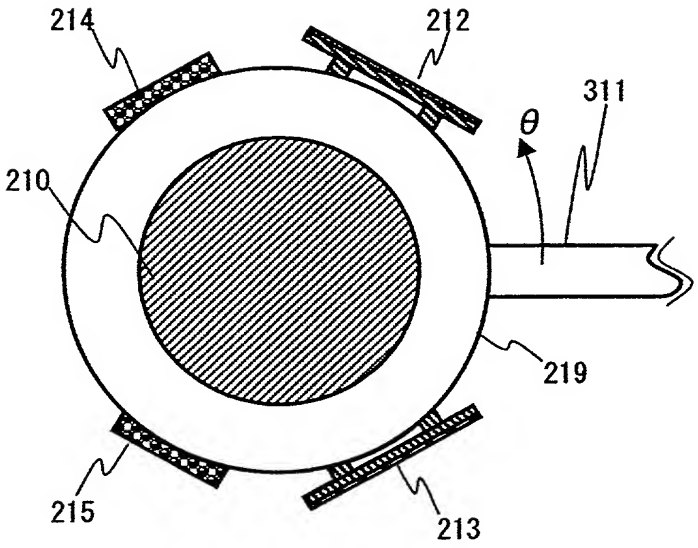


FIG. 21

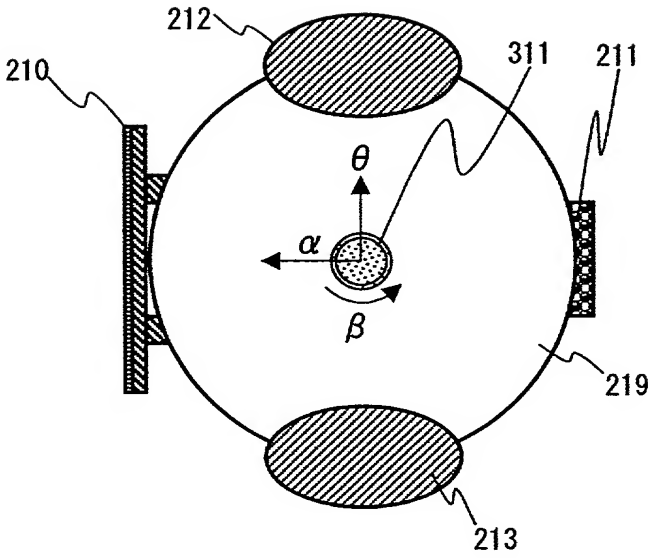


FIG. 22

4,065,464 - 05/25/93

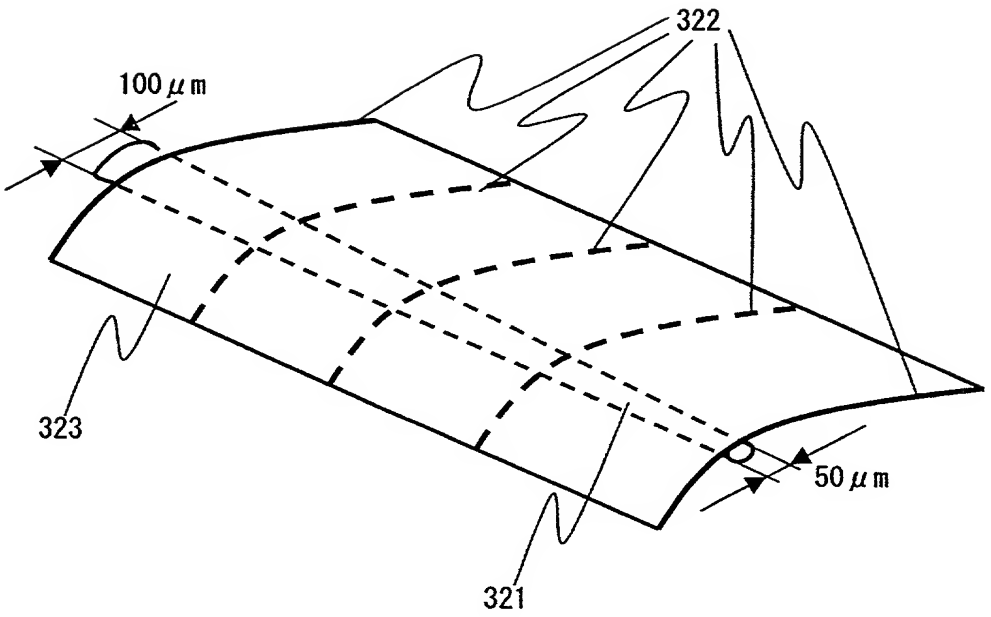


FIG. 23

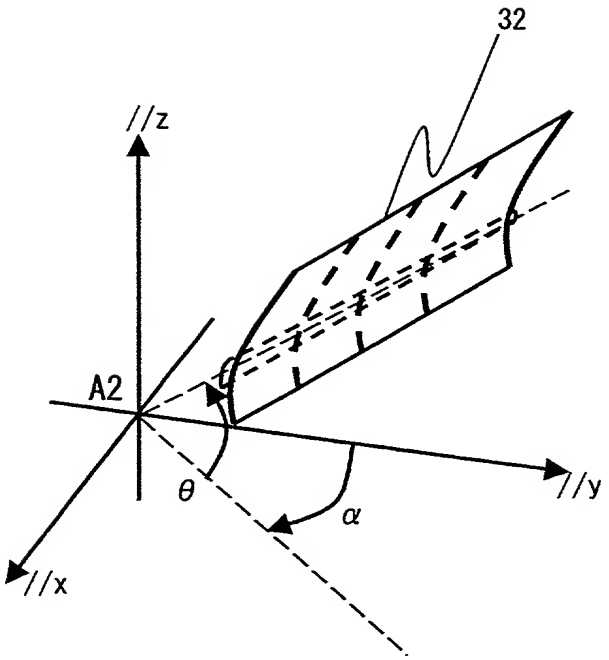


FIG. 24

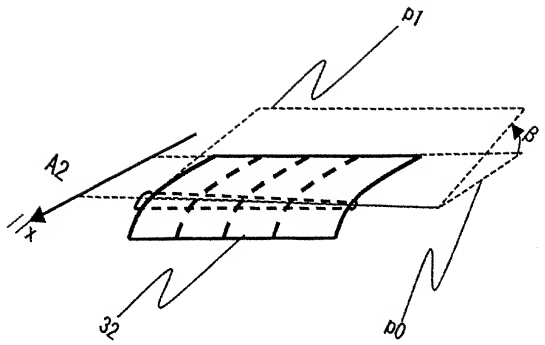


FIG. 25

EP 2 784 564 A1 30-09-2014

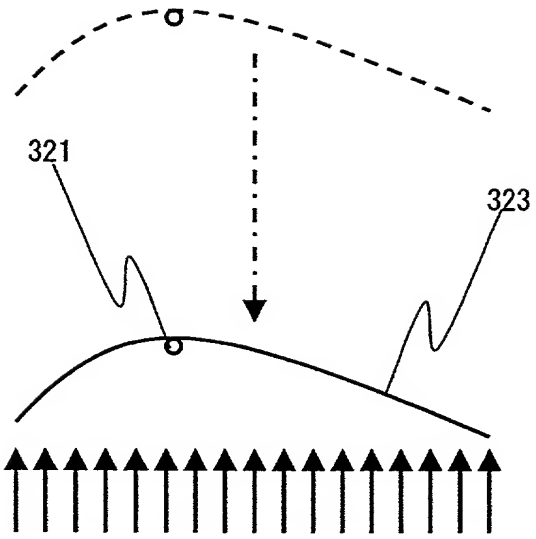


FIG. 26

1006504.052705

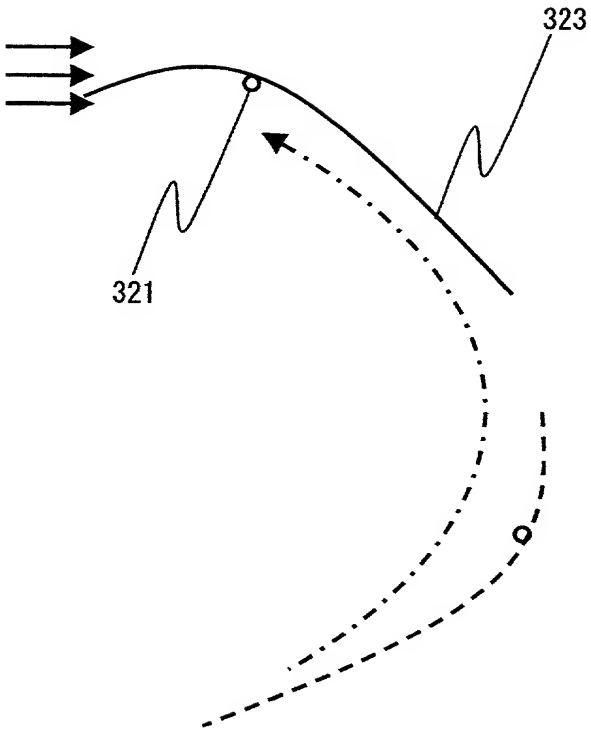


FIG. 27

EP 2 784 564 A1 02-10-2014

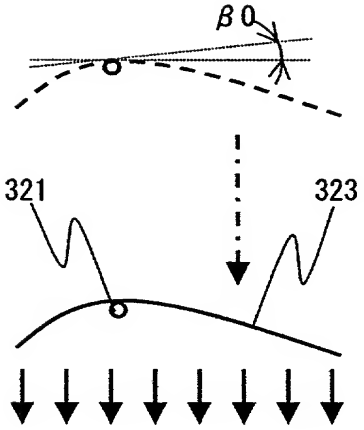


FIG. 28

2007/05/01 15:58:41 - 02/22/2007

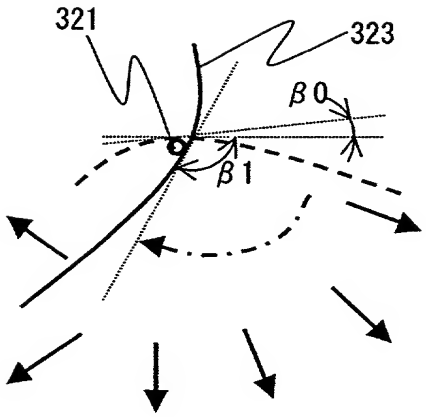


FIG. 29

EP 3 954 894 A1

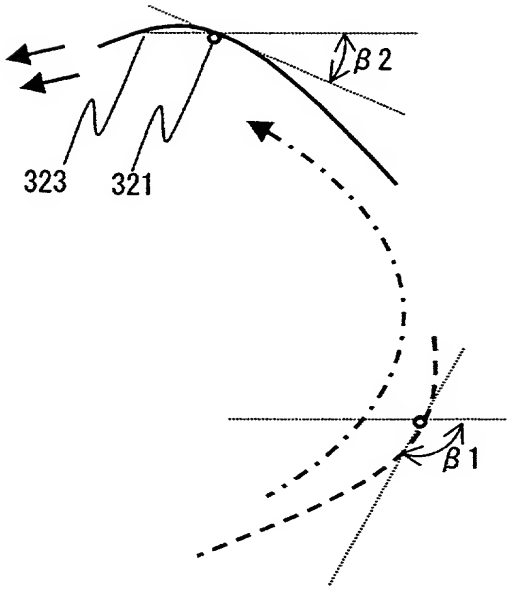


FIG. 30

1005464 - 0225

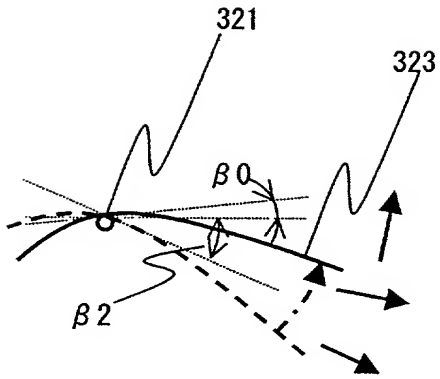


FIG. 31

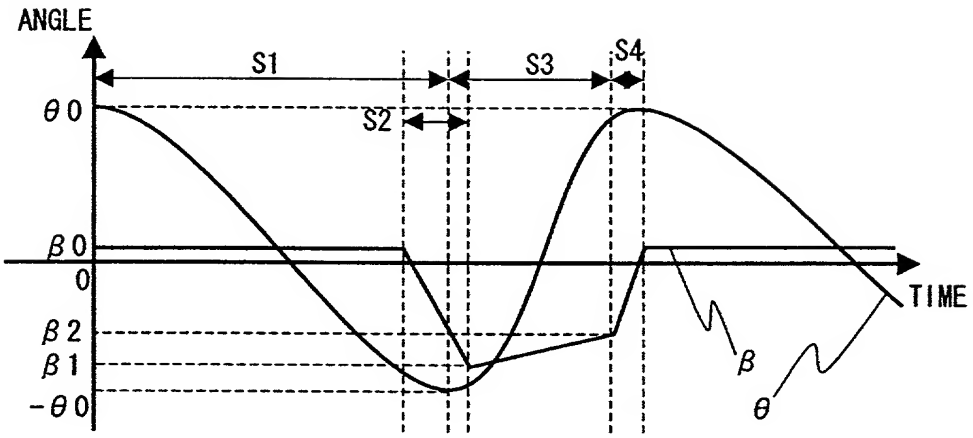


FIG. 32

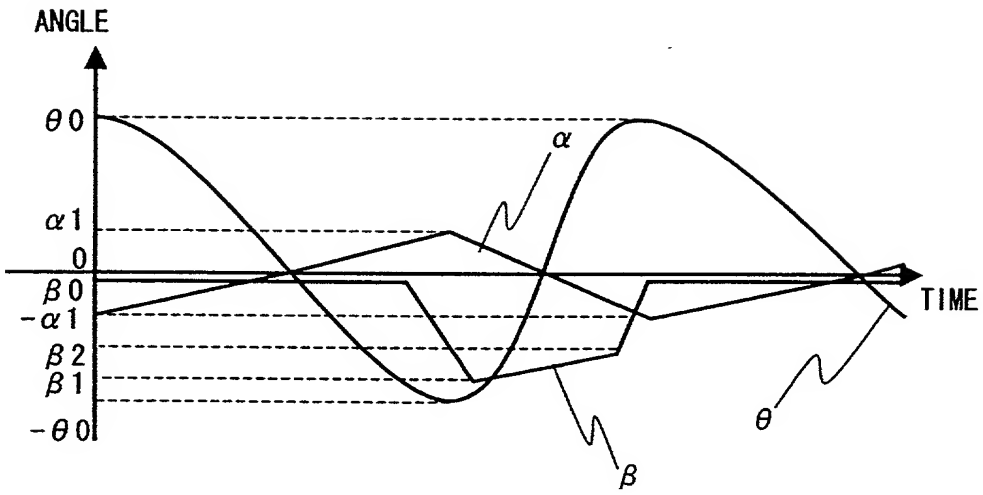


FIG. 33

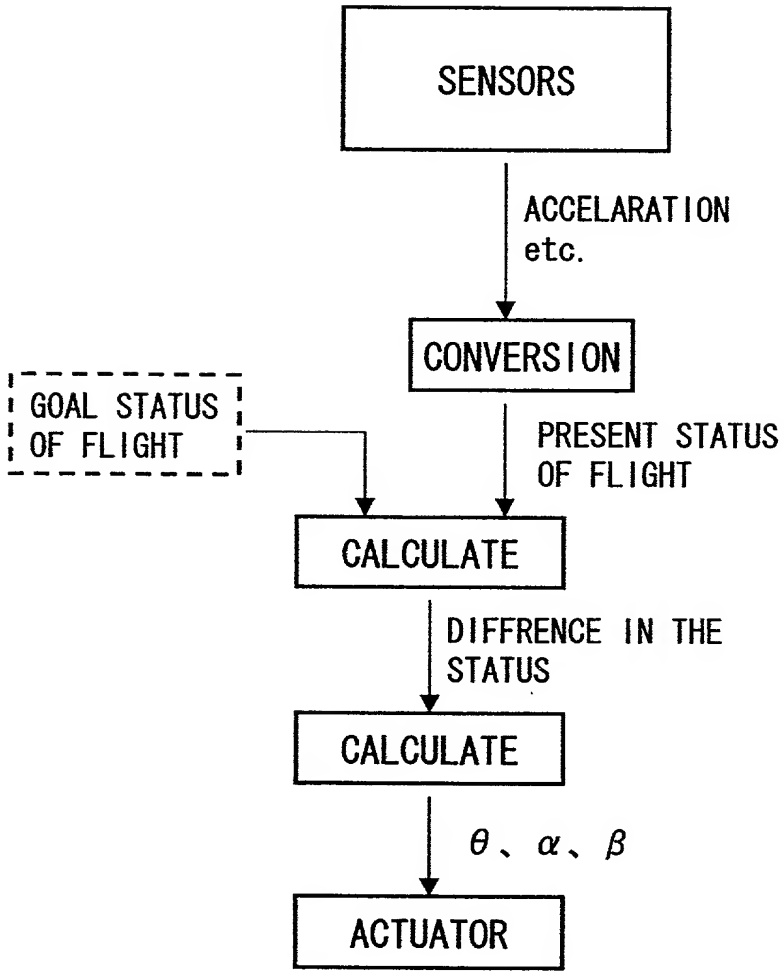

SENSORS
ACCELARATION
etc.
CONVERSION
GOAL STATUS
OF FLIGHT
PRESENT STATUS
OF FLIGHT
CALCULATE
DIFFRENCE IN THE
STATUS
CALCULATE
θ、α、β
ACTUATOR

FIG. 34

EP 2 993 764 A1

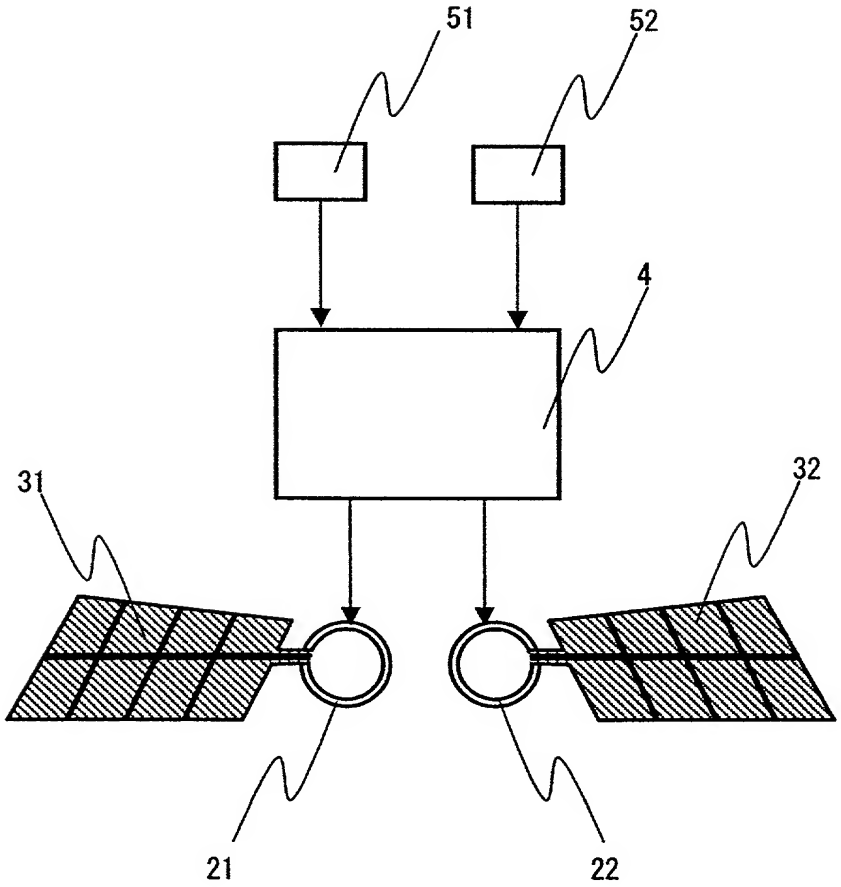


FIG. 35

EPSON TECHNOLOGY

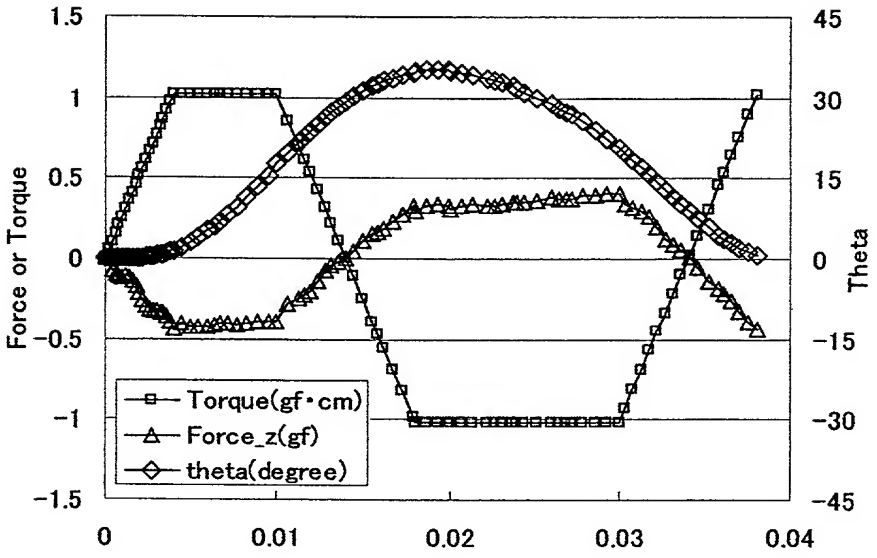


FIG. 36

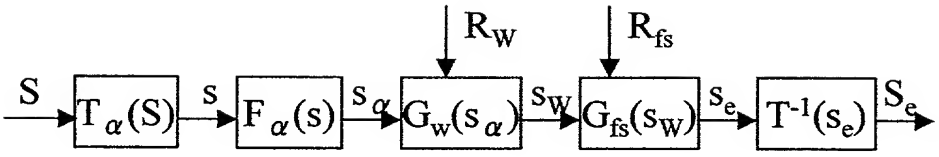


FIG. 37

		x''	$+x''$	$-z''$	$+z''$	$-\theta_y''$	$+\theta_y''$
S1	stroke $\theta\uparrow$			◉			
	stroke $\theta\downarrow$				◉		
	$-d\theta/dt\uparrow$			◉			
	$-d\theta/dt\downarrow$				◉		
	$-d\alpha/d\theta>d\alpha_{th}$	◉					
	$-d\alpha/d\theta<d\alpha_{th}$		◉				
	β is about vertical to sroke direction.			◉			
	β is not vertical to sroke direction.				◉		
	$\beta>0$	◉					
	$\beta<0$		◉				
S2	$-d\beta/dt\uparrow$	◉		◉		◉	
	$-d\beta/dt\downarrow$		◉		◉		◉
S3	stroke $\theta\uparrow$				◉		
	stroke $\theta\downarrow$			◉			
	$d\theta/dt\uparrow$				◉		
	$d\theta/dt\downarrow$			◉			
	$d\alpha/d\theta>d\alpha_{th}$		◉				
	$d\alpha/d\theta<d\alpha_{th}$	◉					
	β is about vertical to sroke direction.				◉		
	β is not vertical to sroke direction.			◉			
S4	$d\beta/dt\uparrow$	◉			◉		◉
	$d\beta/dt\downarrow$		◉	◉		◉	

FIG. 38

	RIGHT ACTUATOR		LEFT ACTUATOR	
	DRIVING FREQ.	MOTION PATTERN	DRIVING FREQ.	MOTION PATTERN
UP	35Hz	B	35Hz	B
DOWN	25Hz	B	25Hz	B
GO FORWARD	30Hz	A	30Hz	A
HOVER	30Hz	B	30Hz	B
TURN RIGHT	30Hz	B	30Hz	A
TURN LEFT	30Hz	A	30Hz	B

FIG. 39

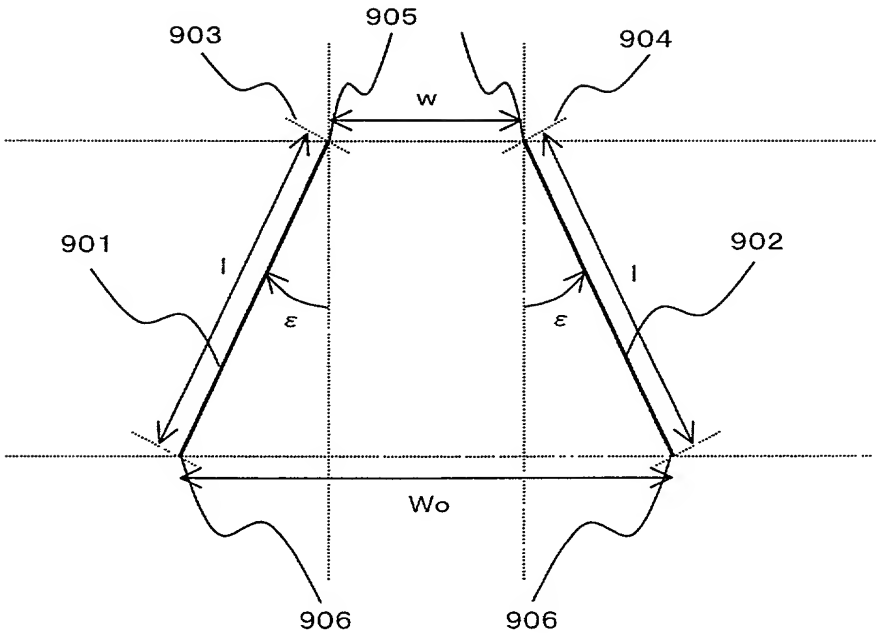



FIG.40